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South Arabian sibilants and the Šherēt ṣ̌ ~ ṣ̌ contrast¹

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The consonant systems of the individual Modern South Arabian languages pose a challenge to linguists working on these languages. In comparison with scholarship on the phonology and phonetics of other Semitic languages, there is surprisingly little work published on Modern South Arabian phonology and phonetics, and even less of this is grounded in primary first-hand data.

In this context, we present in this article a study of Šherēt ṣ̌,² taking as a starting point previously published accounts of the Šherēt voiceless sibilants. Fieldwork conducted by Watson indicated that aspects of the little that the scholarly world knows and perpetuates about Šherēt ṣ̌ were incorrect, so to this end we present in this article a revised account of this consonant. In exploring the question of the origin of the Šherēt ṣ̌, we start by outlining the historical correspondences of the Modern South Arabian (henceforth MSA) sibilants –

¹ The authors are indebted to Barry Heselwood for his time, help and expertise with the electropalatography and to Miranda Morris for making her sound files available to us. We also thank Ayman Ghummad for his patient assistance with EPG investigations conducted in 2015. We would also like to thank our language consultants, and in particular the following, without whose participation the work would not have been possible: Ali al-Mahri, Saeed al-Mahri, Mohammad al-Mahri, Khalid Selim Ruwaya, Faysal Bakhit al-Mahri and Muhammad Ahmad Ali Amar al-Gid al-Mahri. Finally, thank you to Watson's 'whatsapp' consultants Abdullah Musallam al-Mahri, Ahmad Hardan and Khalid Ruweya al-Mahri for checking data themselves, and in the case of Abdullah, with Šherēt speakers in the field. We are grateful to the Leverhulme Trust for project grant RPG-2012-599, which enabled this work to be carried out.

² There is a considerable amount of variation in the terms for this language, as noted by Simeone-Senelle (1997:379). It is commonly known as Jibbāli (in Arabic and much western literature on the language) or Geblēt (in Šherēt), but this designation is, in our opinion, incorrect. In Šherēt and other MSAL of the mainland, the mountains of Jabal Al Qara and Jabal Al Qamar that receive the monsoon rains are known as *šher* (Šherēt, Hobyōt), *šhayr* (Mehri), *šher* (Baḥari) and hence the name of the language, *šherēt* in Šherēt and *baḥlūt šhayr* in Mehri (a term that describes both the Šherēt-speaking people and the language), denotes the language of the people who reside in the monsoon-affected mountains. These mountains are distinguished from the dry mountain ranges further east and west, which are known as *gyel* in Šherēt.

including Ancient South Arabian³ (ASA) s^1 , s^2 , s^3 – and equivalences that are known in contemporary MSA. We then move on to a synchronic view of Šherēt \tilde{s} , which is a typologically unusual sound, recognised for Central Šherēt, but previously said not to be present in Eastern Šherēt. Contrary to what was previously perpetuated in the scholarly literature, we show that the \tilde{s} is indeed also a feature of Eastern Šherēt. We outline the phonological status of these sibilants, and then present evidence of how the \tilde{s} is actually realised by different speakers, with perceptual, with visual, and with articulatory (palatographic) evidence of the articulation of the sibilants in Šherēt. It becomes clear that there is considerable variation, but that it is not phonetically simply a rounded counterpart of \check{s} , and we argue that it is most often alveo-palatal for speakers who have a clear distinction.

1 Background

1.1 Outline of the Modern South Arabian languages

The Modern South Arabian (MSA) languages are a group of related south Semitic languages spoken in the southern part of the Arabian Peninsula, predominantly in Yemen and Oman. Traditionally, they were classified as southeastern members of the South Semitic branch of West Semitic along with ASA and Ethio-Semitic languages, with Arabic forming the other branch of South Semitic group.⁴ Under a revised classification⁵ accepted by many (but not all) Semitists, the MSA languages are now considered to be eastern members of the South Semitic branch of West Semitic, while the Ethio-Semitic languages are the western members; the main difference being that Arabic and ASA are now considered to be less closely related

³ We use the term adopted by Michael Macdonald (e.g. Macdonald 2000:30), noting that he rejects the nomenclatures Epigraphic South Arabian (as describing “a language group by the materials on which it is written”) and Old South Arabian (as misleading, since it incorrectly implies direct ancestry of MSA). As Macdonald notes, ASA is a collective label covering both the Šayhadic languages (Sabaic, Maḍābic, Qatabanic and Ḥaḍramitic, which are the languages traditionally known as ‘Epigraphic’ South Arabian, Altsüdarabisch, etc.) and the non-Šayhadic languages – the other ancient languages of the region of which not much is known.

⁴ This view prevailed throughout much of the twentieth century, e.g. Brockelmann (1961), Moscati *et al.* (1964), Ullendorff (1970), Bergstrasser (1983). For discussion, see Faber (1997), Huehnergard (1995, forthcoming).

⁵ Started by the work of Robert Hetzron (e.g. 1974, 1976).

to MSA languages than previously, being part of the Central branch of West Semitic, along with Northwest Semitic languages such as Hebrew, Aramaic, and so on.⁶

The six MSA languages are Mehri, Šherēt, Ḥarsūsi, Baḥari, Soqotri and Hobyōt. Those with the largest number of speakers are Mehri (also the most geographically widespread), Soqotri and Šherēt, although estimates vary considerably. For Mehri it is particularly difficult to estimate speaker numbers, partly because there are no reliable census figures for ethnic groups, partly because many Mehri tribal members do not actually speak Mehri, and partly because the speech community is spread from eastern Yemen (Qishn, as the west-most point of the Mahra), to Dhofar in Oman, and north into Saudi Arabia. Watson (2012:1) notes reasonable estimates of 100–180,000, although some contemporary estimates set the lower end as low as 75,000 speakers.⁷ For Šherēt, estimates are also not easy because many Šherēt speakers are from the Mahra tribes, for one reason, although a reasonable estimate might be around 30,000 (Watson 2012:1).⁸ Hobyōt and Ḥarsūsi are both estimated to have under 1000 speakers,⁹ and Baḥari now under 20 (Miranda Morris, p.c.).¹⁰ Tom Johnstone, author of the *Mehri Lexicon*, *Jibbāli Lexicon* and *Ḥarsūsi Lexicon*,¹¹ believed that all the MSA languages were severely endangered, stating in 1982 that Mehri, Šherēt, and Ḥarsūsi were “in grave danger of dying out” and that “all three languages will have been replaced [by Arabic] within ten years”;¹² fortunately, both Mehri and Šherēt are still spoken, although the predominance of Arabic threatens both. There is renewed interest in intangible

⁶ This is based on the latest work by Huehnergard (2017), cf. also Huehnergard (1995), Huehnergard & Rubin (2011). A similar (revised) classification, but with some crucial differences, is to be found in Faber (1997), who notes that her model is based on the revisions of Rodgers (1991) and Huehnergard (1992) to the work by Robert Hetzron previously cited.

⁷ See Rubin (2010b:8).

⁸ Rubin is more optimistic, giving 30–50,000 (2010b:8; 2014:3).

⁹ Watson (2012:1), Rubin (2010b:8).

¹⁰ Watson (2012:1). This is down from the 300 speakers estimated by Morris (1983:130), see Simeone-Senelle (2011:1075).

¹¹ Johnstone (1987, 1981, 1977).

¹² Quoted from “Jebali Dictionary to Be Ready by 1982: Prof. Johnstone Tries To Record Dying Languages”, in the *Times of Oman*, January 17, 1980, a cutting of which is to be found in the archive that Johnstone bequeathed to Durham University, and which is now the University’s Palace Green Library (JOH31).

cultural heritage, as evidenced in the collection of oral poetry, tales and histories by both native speakers and non-native speakers, and this may help to prevent further weakening of the languages, particularly with the advent of social media and the development of mobile phone technology, meaning that at least some of the MSA languages are now commonly being written, even if mostly informally.

¹³The earliest major work on the MSA languages arising from primary fieldwork was the documentation of the Vienna expedition in the early twentieth century, published as Jahn (1905) and Bittner (1909–14). Following this was the pioneering work of T.M. Johnstone that culminated in the lexica of Mehri, Ḥarsūsi and Šherēt (the *Jibbāli Lexicon*), as noted above, but which was cut short by his sudden and untimely death. The study of these languages was further developed by fieldwork conducted by Antoine Lonnet and Marie-Claude Simeone-Senelle,¹⁴ and on Soqotri by Vitaly Naumkin and Vladimir Porkhomovsky.¹⁵ Fieldwork on Mehri was begun by Alexander Sima, but this was also curtailed by his tragically early death while conducting fieldwork in eastern Yemen in 2004.¹⁶ Work on Mehri has continued with fieldwork conducted by Watson¹⁷ and by members of the French-led OmanSAM team. A Šherēt grammar based on Johnstone’s materials but with fieldwork conducted with native-speaker informants in the US has also recently been published¹⁸ by Aaron Rubin, a habilitation on the MSA verb system has been completed by Julien Dufour, and Watson has been undertaking fieldwork on Šherēt in Oman since 2013. There have recently been two large projects investigating various aspects of the MSA languages and working with primary material: a Leverhulme-funded project led by Watson, with fieldwork in Oman being conducted by her, Domenyk Eades and Miranda Morris, and the resulting, large corpus of

¹³ An up-to-date, comprehensive bibliography of sources on MSA languages is available in the “Resources” section of the MSAL project website: http://www.leeds.ac.uk/arts/info/125219/modern_south_arabian_languages/2376/resources (last accessed 17th June 2016).

¹⁴ E.g. Lonnet & Simeone-Senelle (1997).

¹⁵ Naumkin & Porkhomovsky (1981, 1995, etc.).

¹⁶ See the work published in Sima (2009) and the “Introduction” by Watson (pp. 1–28).

¹⁷ Producing a number of outputs, particularly Watson (2012).

¹⁸ Rubin (2014).

data being archived with ELAR;¹⁹ and the OmanSAM team funded by the ANR. In addition, in 2015, a team led by Viktor Naumkin and Leonid Kogan published the *Corpus of Soqotri Oral Literature*.²⁰ Other work on MSA languages based on previously published or otherwise available material has also contributed considerably to the body of literature.²¹

¹⁹ Endangered Languages Archive, based at SOAS in London <http://elar.soas.ac.uk/> (last accessed 17th June 2016).

²⁰ Naumkin *et al.* (2014).

²¹ Such as (but not limited to) Leslau (1938), Wagner (1953), Stroomer (1999, 2004), Rubin (2010a), as a selection of the larger works, in addition to various smaller articles.

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	Proto-Semitic	Ancient South Arabian²²	Šherēt	Mehri	Ḥarsūsi	Soqotri
<i>Lateral</i>	*ś	s ₂ <š> ?[t]	ś	ś	ś	ś
	*š	ś	ś ²³	ś	ś	ś
<i>Sibilant</i>	* ^t s	s ₃ <š> ?[ts] ²⁴	s	s	s	s
	* ^d z	z	z	z	z	z
	* ^t š	š	š	š, ṣ̌	š	š
	*s	s ₁ <s> ?[s/š]	š, ṣ̌ ²⁵	š, h	š, h	š, h
<i>Velar</i>	*k	k	k	k	k	k
	*g	g	g ²⁶ , ž, ẓ̌	g, ž	g	g, ž
	*ḳ	ḳ	ḳ, ṣ̌, ṣ̣̌	ḳ, ṣ̌	ḳ, ṣ̌ ²⁷	ḳ, ṣ̌

Table 1 Proto-Semitic and Ancient South Arabian sibilant correspondences and allophones across Modern South Arabian

²² Among others, see in particular Nebes & Stein (2004), Stein (2011), Gragg (1997); also, Beeston (1962, 1984:8–9).

²³ This is often transcribed in the literature as <ž> or <ẓ̌>, e.g. Johnstone (*inter alia*), Rubin (2010a, 2014), Kogan (2011), among others.

²⁴ Traditionally, s₁ was assumed to have had the value [s], but recent work increasingly points towards [ts]. This is comprehensively discussed in Kogan (2011 : 65–69).

²⁵ Note that ṣ̌ also arises synchronically as an allophone of k.

²⁶ This is often rather palatalised, g^y, and in Western Šherēt and for some Eastern Šherēt speakers is j (IPA [dʒ]). Rubin (2014:26) notes j only for Western Šherēt.

²⁷ Swiggers (1981:360) comments on its extremely limited distribution in Ḥarsūsi; here, we should add that ṣ̌ has very limited distribution in all the MSA languages and is found in comparatively few lexemes.

1.2 Historical outline

Table 1 shows the system of sibilants and laterals across four MSA languages, with the corresponding historical antecedents reconstructed for Proto-Semitic, and the corresponding ASA consonants, including the problematic sibilant $s_1 - s_2 - s_3$ series.²⁸

As the table shows, the sibilants include the Šherēt palatal sibilant series, with \tilde{s} , usually noted as a marginal phoneme, since it is said to occur only in Central Šherēt, and its emphatic counterpart $\tilde{\text{ṣ}}$.

Synchronically, Šherēt \tilde{s} is a lexical segment (i.e. a phoneme in its own right), as well as being derived via palatalisation of /k/ (i.e. it also occurs as an allophone of /k/). Šherēt emphatic $\tilde{\text{ṣ}}$ is a lexical segment (independent phoneme), as well as being derived via palatalisation of /ḳ/ (i.e. it also occurs as an allophone of /ḳ/); the lexical $\tilde{\text{ṣ}}$ has very limited distribution.²⁹ The Mehri emphatic ṣ is the emphatic counterpart of \tilde{s} and is similarly very rare. Since this emphatic has such a limited distribution, we have limited speech data for Šherēt that includes it, particularly visual data (video), and due to space constraints we confine the focus of the current paper primarily to \tilde{s} and its contrast with $\tilde{\text{ṣ}}$ and s .

We have included the historical Semitic and the Modern South Arabian correspondences and allophones to highlight the following questions: how do the Šherēt sibilants fit into the Semitic and the MSA sound systems, and where does \tilde{s} come from? One answer to the latter is that the diachronic and synchronic correspondences reveal what is not there. That is, there is no obvious historical precedent to the Šherēt \tilde{s} . Further, looking synchronically across both Semitic more widely, and across the other MSA languages is no more enlightening, since there is no clue here either of any obvious origin for the Šherēt \tilde{s} . This indicates that although – as we demonstrate below – Šherēt \tilde{s} has phonemic status (for many speakers), this must have arisen historically through a phonological process. The logical conclusion is that at some historical point, early Šherēt or an ancestor language variety

²⁸ Among other sources, including the classics such as Moscati *et al.* (1964), see in particular the overview of Huehnergard (1995), alongside Kogan (2011), Goldenberg (2013), Nebes & Stein (2004), Macdonald (2004:499), Ehret (1995:481–2), Steiner (1977).

²⁹ This is marginal, and rare. As indicated in table 1, it derived historically as an allophone of ḳ (Rubin 2004:26).

would have developed a process of contextual palatalisation, perhaps of **k*, such that this historical phoneme (perhaps **k*) would have had (at least) two allophones: [k] and (something similar to) *š̃*; it would seem that at this earlier stage, this ‘perhaps **k*’ did not palatalise to **š̃*, since that would have resulted in a complete merger with the pre-existing *š̃*. This process must have ‘fossilised’ and become opaque, such that *š̃* had a predictable distribution, but could no longer be said to be the output of a synchronic phonological process.³⁰ At some later stage, perhaps due to vowel shift, or perhaps due to koineisation or heavy borrowing from another language variety, a later (modern) stage of Šherēt again developed a context where *k* could be found in a palatalising environment, and developed another – synchronic – process of palatalisation.

Therefore, Šherēt *š̃* has no direct external or historical origin, but arises through a historical stage of palatalisation (the now-lexical *š̃*) as well as resulting from a synchronic process of palatalisation of *k*.

2 Previous studies of MSA sibilants

With respect to the phonology (and in particular the consonantal systems) of the MSA languages, the work of T.M. Johnstone was pioneering, and has at the very least informed, if not constituted the basis of almost all subsequent work on the phonology and phonetics of the Modern South Arabian languages. His main informants for Šherēt, Sālim Bakhīt and Ali Musallam al-Mahri,³¹ have also worked with subsequent scholars investigating aspects of Mehri and Šherēt and thus informed later descriptions of the phonetics and phonology of these two MSA languages.

Of special relevance to the current article are Johnstone’s descriptions of the sibilants, particularly the *š̃* of Šherēt, the existence of which was first reported by Johnstone in a paper he delivered to the Third International Hamito-Semitic Congress in London in 1978 (later published as Johnstone, 1984). This paper was entitled “New Sibilant Phonemes in the

³⁰ The reader is referred here also to the discussion and correspondences given in Kogan (2011:107) as well as Lonnet & Simeone-Senelle (1997).

³¹ Ali Musallam was a native speaker of Mehri who learnt (Eastern) Šherēt during his childhood, and he was initially Johnstone’s informant for Šherēt before Johnstone met Sālim Bakhīt, a speaker of Central Šherēt.

Modern South Arabian Languages of Dhofar”, and he discusses therein four sibilants that he has found in the Central dialect of Šherēt, and which had hitherto been unrecorded: *š*, *ž*, *ṣ̌*, *ẓ̌*. He explicitly contrasts both Eastern Šherēt and Mehreyyet (Dhofari) Mehri, in which he has not found these sounds. The first of these, *ṣ̌*, he notes may be both phonemic – as the result of the splitting of Šherēt *š* into *š* and *ṣ̌* – and allophonic (through palatalisation of *k*), as we also noted in the previous section. He then describes the articulation of *ṣ̌*: “pronounced with the blade of the tongue on the hard palate and the lips protruding: the breath is forced between the blade of the tongue and the hard palate.” The status of the voiced counterpart *ẓ̌* he describes as only an allophonic variant of *g*³²; it is noteworthy that in his *Jibbāli Lexicon* (1981, henceforth *JL*), he does not mention a *ẓ̌* variant of *g/j*. The *ṣ̌* is the emphatic counterpart of *š*, and has both lexical status and may be derived through palatalisation of *k*; he finds the lexical *ṣ̌* to be the Central equivalent to Eastern Šherēt (and Mehreyyet) *š*.

Here we focus on *ṣ̌*, with some discussion of its emphatic counterpart *ṣ̣̌*, while the *ẓ̌* we leave for future work. All these sounds are highly variant, and appear to be dependent on several phonological contexts (segmental context, prosodic context, and phrasal context) as well as the sociolinguistic context of the speaker. Thus, the reports of the *ẓ̌* allophones need detailed, careful testing in a large number of phonological contexts with a range of speakers.

Having established this focus, it is also worth quoting in full here two comments that Johnstone presents in *JL* (1981:xiv), since this underlies what has been said about Šherēt *ṣ̌* in the 35 years since. Firstly, he comments that he has found that “The C[entral] dialect of Jibbāli has two phonemes: *ṣ̌* and *ṣ̣̌*, where E[astern] has only one, namely *ṣ̌*.” Secondly, he describes the articulation of *ṣ̣̌* as follows:

The C *ṣ̣̌* is pronounced with approximately the same tongue position as *ṣ̌* but there is no contact between the top [*sic*] of the tongue and the alveolum. The air is pushed out over the tongue and the lips are simultaneously rounded and pouted.

³² Johnstone (1984) uses <j> to transcribe this segment, unlike in *JL*, where he uses <g>.

It is a tribute to Johnstone's contribution to the field of MSA studies that these observations underlie what is still generally believed today about Šherēt *š̃*. We note that it is his *JL* description that seems to have taken hold, and that there is some small difference in his original description of the articulation of *š̃* as regards the blade of the tongue and the palate, which is actually rather hard to effect, and which he has apparently amended slightly in the *JL*. Nevertheless, the two points that one may draw from the above are that (1) *š̃* is only found in Central Šherēt, and (2) *š̃* is a labialised palato-alveolar, and as such produced like *š* with lip-rounding, but with less tongue–alveolum contact. The force of his observations concerning *š̃* that we quoted above – and as summarised in (1) and (2) – may be seen in subsequent reiterations of these two points. For instance, details given by Simeone-Senelle (2011:1077) are that the “Central dialect of Jibbali...has a phoneme /š̃/ (labialized *š*) contrasting with /š/”, while “the Eastern dialect...has only /š/”. Rubin (2014:26) provides the following: “The phonemes *š̃* and *š* are distinguished only among some speakers of CJ. Otherwise, both are pronounced as *š*”, and he also gives a description of the sound *š̃* by quoting verbatim (p.26) from Johnstone's *JL* (1981:xiv) the passage we cited above.³³ Similarly, Lonnet & Simeone-Senelle (1997:364) state that Central but not Eastern Šherēt displays strongly labialised sibilants *š̃*, *š̂*, *ṧ* (“le jibbali du centre, non celui de l'est, présente des sifflantes particulières...fortement labialisées”), and they also quote (in translation) Johnstone's *JL* description of the articulation of *š̃* given above. Dufour (2016:24) describes /š̃/ as closer to [ç] than [ʃ],³⁴ and states that “Le /š̃/ en diffère principalement par la labialisation, bien que la zone de contact entre la langue et le palais y paraisse plus réduite que pour /š/”.

In this current article, we aim to advance knowledge of the Šherēt sibilant system by challenging assertions (1) and (2) above. To this end, in the following section of this paper, we discuss the results of our investigation into the sibilants of Šherēt, with a focus on *š̃*, and we add to Johnstone's discoveries by showing how *š̃* is in fact found in the speech of (at least

³³ It is noteworthy that Rubin has evidently not confirmed the *š̃* ~ *š* contrast amongst the native speakers whom he consulted. We observe that his informants are all heritage speakers of Šherēt and younger generation, which is a point that we return to in section 4 on the sociolinguistic situation. We also note that Rubin (2014:26) is quite correct in his understated observation that *š̃* contrasts with *š* for only some speakers of Central Šherēt, which is confirmed by our own data, as discussed below.

³⁴ Which we show below to be incorrect.

some) Eastern Šherēt speakers,³⁵ and that its production is not similar to the hushing (chuintante) sibilant *ʃ*, but rather seems to be closer to the hissing (sifflante) sibilant *s*.

3 Analysis of Šherēt voiceless sibilants

In this section, we discuss the results of an instrumental phonetic study of the Šherēt voiceless sibilants, in which we investigated the articulatory angle through an electropalatographic study, in addition to visual evidence in the form of video; we also conducted some acoustic analysis.

3.1 An EPG analysis of Šherēt sibilants

Electropalatography (EPG) is a way of showing oral articulation by recording articulator contact. The speaker is fitted with a false palate made of acrylic resin, into which are embedded 62 silver contacts,³⁶ arranged in rows to cover the major zones of the palate, as shown on the left in Figure 1, below. As the palate-wearer speaks, each electrode records contact, which is sampled by the software at up to 100 frames per second, and subsequently shows as black-shaded squares on the resulting palatograms, as can be seen on the right in Figure 1. Looking across the palatograms generated for a recorded speech string allows the analyser to see real-time articulation via the recorded pattern of palate contact.

[FIGURE 1 HERE]

Fig. 1 A Reading palate (l), shown next to one frame of a palatogram (r) generated by ArticulateAssistant during J001's articulation of ʃ of Šherēt /šehey/ 'tea'³⁷

³⁵ A finding also made recently by Dufour (2016).

³⁶ This is the most common type of palate used in Europe, the Reading Palate (see Wrench 2007 for discussion).

³⁷ This frame shows asymmetrical tongue contact with the sides of the upper palate from rows 2–8, i.e. as far forward as alveolar.

With the help of Barry Heselwood, the authors conducted electropalatographic work in the phonetics laboratory at the University of Leeds between October 2012 and October 2015 with four male MSA speakers aged in their 20s – 40s. The participants were M001 (a monolingual Mehri speaker from Rabkut), J003 (a bilingual Mehri / Šherēt speaker from Gabgabt and Salalah³⁸), J001 (a bilingual Šherēt / Mehri speaker from Gabgabt and Salalah), and J043 (a monolingual Šherēt speaker from Sudh). In the current article, we discuss the implications of analysis of relevant data from the three Šherēt speakers, J003, J001 and J043. The data were recorded via a Reading palate (J001 and J003), and an Articulate palate (J043) using ArticulateAssistant, with accompanying WAV files recorded simultaneously onto a PC via Audacity. Laryngography was also conducted in some cases, but this is not discussed here as it is not relevant to the current paper.

From the palatographic data recorded with the three Šherēt speakers, we looked at the following sounds for the purpose of the current study: 34 tokens of emphatic *ṣ̣*, 47 of *ṣ̥*, 51 of *ṣ̌* and 32 of *s* (a total of 164 tokens, in 151 individual palatograms, sampled at a rate of 100 per second). The phonological environment of the tokens varied in terms of position and syllable stress, as well as the segmental context (adjacent consonants and vowels). The only clear phonological environment that may have had an effect was that where the relevant consonant was followed by a rounded vowel, although this more obviously affected lip protrusion (visible on the videos and audibly perceptible) than the tongue gestures measured by palatography.

One interesting result to emerge from a visual assessment of the palatograms was that the three speakers with whom we have been able to conduct palatography varied, apparently along the lines previously known, i.e. that the two speakers of Central Šherēt had a distinct *ṣ̥*, which contrasted with *s* and *ṣ̌*, while the one speaker of Eastern Šherēt who participated in palatographic experiments did not have a clear *ṣ̌* ~ *ṣ̥* contrast. We will show in the following sections, however, that what appears to be dialectal variation is actually not the case; this demonstrates the problem with relying on data from too few speakers, particularly when working on under-studied or minority languages for which there is comparatively little data available.

³⁸ Place of birth and normal place of habitation.

As noted above, one of the three EPG participants – J043 – is an Eastern Šherēt speaker. This speaker was the last of the three to participate in this work (in spring 2015); we examined 103 tokens of the target segments (\tilde{s} , \tilde{s} , \check{s} , s) from 97 palatograms. The palatograms were not always easy to interpret, as they showed considerable variation in contact for the various consonants we looked at, and in some cases little discernible pattern was evident. However, one pattern was that in final position these four sibilants showed a tendency to lenite strongly; intervocalically there was also some tendency towards lenition, i.e. the tongue made far less contact with the palate, in many cases only the side rows towards the back (the palatal to velar region). The second main observation was that the wide variation we could see in the articulation of these consonants occurred amongst the tokens of individual consonants; in this speaker's data, we did not find clear contact patterns that differentiated \tilde{s} and \check{s} from \check{s} , and s was not as clear as expected, either, although for s there was evidence of some alveolar approximation with a wide (contactless) channel running through the oral cavity, while \tilde{s} , \check{s} and \check{s} were more likely to have some contact around the side in the palatal region. We did not find evidence in this data of this speaker having a contrast between \tilde{s} and \check{s} .

The earlier EPG experiments with speakers J001 and J003 were far more conclusive, and the sibilants much clearer on the palatograms. Both of these participants are speakers of Central Šherēt. For J003 – our first EPG subject – we found 18 tokens of the target segments (\tilde{s} , \check{s} , \check{s} , s) from 11 palatograms. On visual assessment of the palatograms, while there was some variation evident, we could nevertheless see that generally \tilde{s} had a similar oral contact pattern to s , with contact as far forward as the alveolar region, while \check{s} had a clearly different pattern with no tongue contact further forward than the palatal region. This is demonstrated in figures 2–3, below. The contact pattern for \check{s} was again generally distinct, with a tendency to have the narrowest (contactless) channel running from back to front of the mouth, and therefore a relatively greater area of tongue–palate contact than the other three sibilants, and with little to no contact in the velar and post-palatal regions, but contact towards the front (the alveolar region).

[FIGURE 2 HERE]

Fig. 2 Palatogram showing contact patterns during J003's production of *šes*, extracted from */šes lo/* 'not with her' (left) and *šeš*, extracted from */okšeš lo/* 'not fat' (right)

[FIGURE 3 HERE]

Fig. 3 Palatogram showing contact patterns during J003's production of *šes*, extracted from a token of the phrase */šes lo/* 'not with her' (a different token from fig. 2 above)

The data from J003 are interesting for two reasons. One is that it bears out the reports of a contrast between *š̃* and *š* in Central Šherēt; the other is that it indicates that *š̃* is produced with an oral gesture that in terms of contact with the upper palate looks similar to *s*, and not to *š*. This should be considered in the context of Johnstone's description of *š̃* as being like a labialised *š* with "no contact between the top [*sic*] of the tongue and the alveolum".

Lastly, the data from the third EPG participant – J001 – are particularly revealing. We examined 43 tokens of the target segments (*š̃*, *š̃*, *š*, *s*) from 43 palatograms for this speaker, and these gave us the clearest data overall. Firstly, this speaker had a clear contrast between *š̃* and *š*. The *š̃* was produced with contact in the alveolar region, similarly to *s*, except that the area of contact was greater for *š̃*, particularly in the palatal region, and sometimes there was more narrowing of the channel. This means that for this speaker, *š̃* is being produced with air forced through a narrow gap in the alveolar to post-alveolar region, compared with *s*, for which air flows through a (sometimes) less narrow gap in the alveolar zone of the oral cavity. This is demonstrated in figure 4, below. On the other hand, *š* is very distinct and clear for this speaker: this had the least tongue contact with the upper palate, and showed a wide (contactless) channel going through the velar and palatal region, and typically no contact around the alveolar region. This is to be seen on the right-most palatogram in figure 4.

[FIGURE 4 HERE]

Fig. 4 Individual frames of cumulative EPG contact data showing maximal constriction achieved during J001's production of \tilde{s} in the word / \tilde{s} ehēy/ 'tea' (left), s in the word /derhis/ 'young female goat' (centre), and \check{s} in the word / \check{s} ibʕet/ 'seven' (right)

The data for J001 bear out the data of the other Central Šherēt speaker, J003, in showing a clear $\tilde{s} \sim \check{s}$ contrast, which is very marked in the articulatory pattern. It is also interesting that there appears to be some (much slighter) difference in contact pattern between \tilde{s} and s , since although they both evidence alveolar contact, \tilde{s} is sometimes produced with a narrower channel to force the air through, and greater alveo-palatal to palatal contact. The narrower channel may partially account for its perception as sounding 'whistled', as we note below in discussing the acoustic evidence.

The EPG data support our belief that, in articulatory terms, \tilde{s} is better characterised as alveo-palatal (where \check{s} is palato-alveolar and s alveolar). That is, the greater degree of tongue contact in the palatal and alveolar regions evident in the production of \tilde{s} in comparison with s is indicative of a consonant which is not strictly alveolar (as s), yet is clearly not palatal.

Having examined the tongue articulation evidence, we move on in section 3.2 to visual evidence.

3.2 Video evidence of Šherēt sibilants

It is very clear visually in Šherēt speech that for some speakers at least part of the oral tract is configured differently for \tilde{s} than for both s and \check{s} . Even in fast connected speech, the listener will be aware of lip-spreading versus lip-protrusion affecting consonants and surrounding vowels, and that in the case of consonants, lip-protrusion is not just evident during the production of those which are primarily labial or labio-velar. For \tilde{s} there is lip protrusion that sometimes has a slight off-glide effect into the following vowel, particularly where this latter is a front vowel, as in the word \tilde{s} ighīm 'to come in the morning', for instance. By contrast, s very noticeably lacks this lip protrusion.

We examined seven video recordings recorded individually with three speakers of Šherēt; two videos of J108 (Eastern Šherēt), recorded in a recording studio at the University

of Leeds (October 2015), one video of M026 (a bilingual speaker of Mehri and Central Šherēt), recorded outdoors in Frankfurt, Germany (September 2014), and four videos of J014 (Central Šherēt), recorded in central Dhofar, Oman (2013–2014). Using Movie Maker, we examined individual frames of the recordings so that we could see the lip and jaw movements. It was clear that for these three speakers, the lip position was different for \tilde{s} than for s and \check{s} , as described above. These data were interesting because one of the participants, J108, is a speaker of Eastern Šherēt, which was previously thought not to have a $\tilde{s} \sim \check{s}$ contrast.³⁹ The video evidence showed incontrovertibly that this contrast is a feature of the speech of some Eastern Šherēt speakers.⁴⁰ In our work, we had discovered by chance that speaker J108 had this contrast when talking with J043 about vocabulary in front of J108; J043 seemed unaware of a difference (which is borne out in the EPG analysis discussed above, in which we could find no difference in tongue–palate contact for his $\tilde{s} \sim \check{s}$); when J108 joined the conversation, we noticed that he had a distinct $\tilde{s} \sim \check{s}$ contrast, which further questioning revealed that he was fully aware of.

Analysis of the video recordings revealed that the lip shape for \check{s} seems the least stable, in that there is a tendency towards coalescence, such that the lip shape fairly often varies according to adjacent segments. The neutral state, as evidenced in recordings of J108 in the recording suite at the University of Leeds of \check{s} in the context of a , or elicited alone, is lip spread. With other speakers – natural, narrative speech – we happened to have no clear instances of \check{s} with a . In natural, normal-speed speech for all speakers we looked at, in producing \check{s} preceding a front (unrounded) vowel, the lips are most often spread wide; however, where \check{s} follows or precedes a back (rounded) vowel, there is a noticeable tendency for the lips to assume the non-spread, protruding position of the adjacent vowel.

This contrasts with \tilde{s} and s , which seem more stable in this respect, in particular \tilde{s} , which was always produced with protruding, non-spread lips which often took the shape of a

³⁹ We were introduced to this speaker by chance when he came to the UK for a period of study. The time it takes to have a palate made up prevented us on that occasion from performing EPG experiments. We intend to do this in the near future.

⁴⁰ This supports Dufour's (2016) findings that the presence or absence of the $\tilde{s} \sim \check{s}$ contrast is sociolinguistic rather than geographic.

brief ‘pout’ particularly of the lower lip. As noted above, where this \tilde{s} preceded a front vowel, the effect was almost of a pouted palatal-sounding glide, i.e. $\tilde{s}^h i g h \bar{m}$ ‘to come in the morning’. Lastly, s in all contexts was generally produced with spread lips, without the lower lip pout.

In figures 5 and 6 below, we present video frames showing different lip shape for \tilde{s} in comparison with s and \check{s} . Figure 5 compares (1) s (left) with (2) \tilde{s} (centre) for speaker J108 for Eastern Šherēt,⁴¹ and with (3) \tilde{s} (right) for speaker M026 for Central Šherēt.⁴² These demonstrate the $\tilde{s} \sim \check{s}$ contrast that J108 has, although a speaker of Eastern Šherēt. Figure 6 compares (1) s (left) with (2) \check{s} (centre) and (3) \tilde{s} (right) for speaker J014, Central Šherēt.⁴³ These demonstrate the lip-spread position of s and – in this context – \check{s} , and the lip-pout position of \tilde{s} .

[FIGURE 5 HERE]

Fig. 5 Three video stills showing lip position during articulation of: (1) s in /sīda/ ‘straight’ (J108); (2) \tilde{s} in /šerbaʃ/ ‘cross!’ (J108); (3) \tilde{s} in /šaʃgul/ ‘he hurries’ (M026)

[FIGURE 6 HERE]

Fig. 6 Three video stills showing lip position of speaker J014 during articulation of: (1) s in /yiʃūrēs/ ‘they build it f. up’; (2) \check{s} in /bšaʃak/ ‘you m.s. have chopped it up’; (3) \tilde{s} in /yišīrek/ ‘he does’

⁴¹ The recording was filmed at the University of Leeds, during an experiment that required the participant to discuss directions from one place to another.

⁴² The recording of M026 was filmed in Frankfurt in September 2014.

⁴³ The frames were extracted from video recordings filmed in central Dhofar by Watson in February and November 2014.

To conclude this section, we argue that the term ‘rounding’ is not appropriate for Šherēt \tilde{s} . It is lip protrusion in the form of a pouting gesture which is more evident than actual rounding, and the contrast of this lip position with the lip spreading evident with s and \check{s} . It is interesting also to note that when native speakers of Šherēt describe \tilde{s} they typically do not point out the lip protrusion. This could perhaps be compared with English \check{s} , which is typically produced with lip protrusion, although not generally included as a ‘rounded’ consonant; this is markedly different from \tilde{s} in languages where it is not produced with such lip protrusion, but with spread lips. Therefore, it may not be that lip *protrusion* is as relevant to the identity of \tilde{s} as lip *spreading* is to the identity of s and \check{s} .

3.3 An acoustic analysis of Šherēt sibilants

Finally, we move on to a brief outline of the results of some acoustic assessment we made of s , \tilde{s} and \check{s} . This is a preliminary assessment of the data, and forms part of an ongoing study.

The laboratory-recorded data focusing on sibilants were mostly not usable for acoustic analysis because of the interference of the palate, so for acoustic analysis we looked at recordings of natural speech data. From various audio sound files (in WAV format), we extracted 20 tokens of \tilde{s} , 7 of s and 7 of \check{s} across seven different speakers of both Central and Eastern Šherēt.

A brief outline of the initial assessment we made of the data showed that across the speakers, and given the nature of naturally recorded speech, overall, s and \check{s} looked as expected: the ‘hushing’ sibilant \check{s} has a more widespread aperiodic energy range which is less concentrated and goes much lower than s , with energy as low as c.2000Hz and up to the 5000Hz bar. In certain positions (e.g. intervocalically), and where there is evident voicing, formants may be visible for at least part of the duration. In comparison, s is quite distinct, with concentrated aperiodic energy towards the top of the spectrum, particularly around the 4000Hz zone.

This gave us a point of comparison to start evaluating acoustic data for \tilde{s} . This consonant varies widely both by speaker and by token. In natural, normal-speed speech, and especially intervocalically, it is easily voiced and the relatively short duration makes it hard to measure. Investigation of the acoustics data is further complicated because some

speakers⁴⁴ do not appear to have a $\tilde{s} \sim \check{s}$ contrast (as we noted above for, e.g., J043), and some speakers who do have a contrast seem to vary actual production, at times producing a sibilant which has most of its acoustic energy in the higher range of the spectrum, more like the ‘hissing’ sibilant s , and at other times having a more spread-out energy range, at both high and mid zones of the spectrum, more like the ‘hushing’ sibilant \check{s} . This is not the case for all speakers, for instance speakers J005⁴⁵ and J041⁴⁶ consistently produced a \tilde{s} that clearly contrasted with \check{s} and consistently produced it with an acoustic pattern more like that of s (bearing out the auditory impression that it was a ‘whistled’ or ‘hissing’ sibilant, not ‘hushing’). It is worth noting here the evidence of Šherēt speakers themselves, who describe \tilde{s} as having a whistling sound; this demonstrates the auditory impression created by an acoustically higher frequency than is usual with \check{s} .

Lastly, our assessment of the acoustic data led us to the further conclusion that a pouting lip position may also contribute to the lowering of the frequency of the \tilde{s} . We recall here that the acoustic pattern of \check{s} includes a much lower and more widely distributed frequency than that of s . Indeed, the lowering of the frequency of \tilde{s} through lip-pouting may well be one reason for its merger with \check{s} for some speakers, and its variability for other speakers.

To conclude this section, we sum up our findings that \tilde{s} is not simply a rounded version of \check{s} , and that the $\tilde{s} \sim \check{s}$ contrast is a feature for some Eastern Šherēt speakers (contra the previous literature), while also not being a contrastive feature in the speech of all Central Šherēt speakers.

4 Sociolinguistic situation

We have shown in this article that \tilde{s} is indeed also a feature of the speech of (at least some) Šherēt speakers from the eastern part of the language area and that it is also variable in the

⁴⁴ This applies to speakers of both Central and Eastern Šherēt.

⁴⁵ A female speaker of Central / Western Šherēt, recorded in Dhofar by Miranda Morris in 2013.

⁴⁶ A male speaker of Eastern Šherēt, recorded by Miranda Morris at various times since the early 1980s. The recordings include the one we analysed, which was produced in the laboratory at St Andrews in 1982.

speech of Central Šherēt speakers. However, there is considerable pressure for \tilde{s} to neutralise with \check{s} , and this may be at least partly generational – that is, very generally, there may be more older speakers who have this contrast than younger speakers. For instance, while staying with Šherēt-speaking families during fieldwork in Dhofar, Watson was told by adult speakers that their mothers used to chastise them for using \check{s} in place of ‘the whistled’ \tilde{s} , and would instruct them to use the \tilde{s} appropriately.

Since gradual neutralisation causes inter-speaker variation, this is probably why Johnstone thought that \tilde{s} was a feature of only the Central Šherēt consonant system. It is possible that \tilde{s} had been retained to a greater degree in certain speech areas, although as we have shown in this paper, this includes Central and Eastern Šherēt areas. Further, we have noted quite some variation between speakers in terms of whether there is actually a $\tilde{s} \sim \check{s}$ contrast, and in those speakers who do have this contrast, we have noted variation in actual production of \tilde{s} . This explains why Johnstone may have found this contrast with only certain of his speakers (i.e. the Central Šherēt informants), and why the reports had not been challenged before now.

Given the inter- and intra-speaker variability, we can see that \tilde{s} is a rather unstable consonant. Whether this will eventually lead to a complete merger of \tilde{s} with \check{s} , or whether \tilde{s} is strongly enough tied to Šherēt identity – e.g. in the face of bilingualism with both Mehri and Arabic – is not evident. Therefore, we conclude this section by observing that one possible outcome of such instability as is evidenced in intra- and inter-speaker variation is loss of contrast (in this case merger of \tilde{s} with \check{s}), but that it is equally possible that in the context of increased awareness of Šherēt cultural heritage and a move toward stronger identity politics, that if \tilde{s} is sensed by speakers as an indicator of Šherēt identity, then it may remain distinct. We do not speculate further on the likelihood of either of these two alternatives here.

5 Conclusion

We have discussed in this paper the discovery of a contrast between \tilde{s} and \check{s} for some speakers – but not all – in Eastern as well as Central Šherēt. We have also identified that the \tilde{s} has a range of allophones, some of which are dependent on phonological context, and which have the effect of being for many speakers more *s*-like than *š*-like, both perceptually and in

terms of tongue–palate configuration. We have shown that the lip shape of \tilde{s} is very different from that of s , while the lip-shape of \check{s} is more variant. We have also shown that tongue contact is greater in the alveo-palatal region for \tilde{s} than s , and we posit that ‘alveo-palatal’ is therefore a more accurate articulatory term than ‘alveolar’ or ‘palato-alveolar’. The discovery of a $\tilde{s} \sim \check{s}$ contrast for some speakers of Eastern Šherēt goes against what has been reported in the literature on Šherēt since Johnstone’s initial observations over 30 years ago. We conclude that the reason for his initial discovery of \tilde{s} being confined to his Central Šherēt informants is likely to be the considerable intra- and inter-speaker variability. This variability necessitates investigation of a large amount of data from a range of speakers.

These discoveries are rather exciting, and go some way to showing the enormous amount of work yet to be done on the phonology, phonetics and sociophonetics of the MSA languages. To that end, in this paper, we also discussed the preliminary assessment of acoustic material focused on sibilants. We have begun to systematically analyse more of the acoustic data, and have identified that we also need to record more acoustic data in controlled settings from a range of speakers of the various dialects of Šherēt, continuing with obtaining elicited material focusing on sibilants in different phonological environments, and which can be analysed acoustically. Under the auspices of the current project (described in section 1, above), we have obtained a good amount of data, which we have begun to analyse, and we have identified what more is needed

Clearly, there needs to be further experimental work carried out with a range of Eastern Šherēt speakers. There is definitely a $\tilde{s} \sim \check{s}$ contrast for some speakers of Eastern Šherēt, not just Central, but we have not yet obtained palatographic evidence of this, because of time and funding constraints.⁴⁷ We are working towards rectifying this in the near future, funding permitted, to provide further evidence of the existence of this segment in Eastern Šherēt. We found a distinct $\tilde{s} \sim \check{s}$ contrast for speaker J108, but were not in a position to do EPG work with him while he was here, and would need to obtain funds to bring him back to the UK. EPG work cannot be done in the field. The other possibility would be to do traditional

⁴⁷ For palatography, funding would need to be found to cover the cost of bringing Šherēt speakers to the UK, where EPG facilities are available (as, e.g., the University of Leeds), and for individual palates to be specially made to fit the oral cavity of individual speakers.

palatography in the field, and since the costs and time commitment of EPG work make EPG investigations so difficult, this is another possibility to explore. We also discussed the value of visual evidence, which can be captured on video, and which we demonstrated with comparable video stills presented in figures 5 and 6, above. The videos were filmed in a variety of contexts, most of which meant that the subject was at a distance from the camera, with the resulting films preserved with varying quality; additionally, almost all the videos were of either naturally spoken narrative or of a laboratory experiment focusing on set tasks, which meant that the phonological contexts were not controlled. The visual data are therefore an important initial study which indicate that future research should gather audio-visual data on sibilants specifically for the purpose of visual analysis of mouth / lip shape, with both recording conditions and linguistic context controlled. This will result in more controlled data which are visually clearer. Lastly, we note also that experimental work urgently needs to be carried out with speakers of Western Šherēt, for which there is almost no description in the literature.

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